REMARKS/ARGUMENTS

Status of Claims

Claims 1-7 and 9-30 are currently pending. The Examiner has rejected claims 1-7 and 9-30.

Claim Rejections — 35 U.S.C. § 103(a)

The Examiner has rejected claims 1, 4-7, 9-19, and 23-30 under 35 U.S.C. § 103(a) as supposedly being obvious over U.S. Patent No. 5,953,199 to Owens (Owens) in view of U.S. Patent No. 4,071,785 to Yoshida *et al.* (Yoshida). The claim rejections are respectfully traversed as follows:

Currently amended independent claim 1 is:

> A capacitive touch pad comprising cover and first layers,
>
> the cover layer comprising a non-conductive cover providing galvanic isolation of the first layer,
>
> the first layer comprising a plurality of row-shaped row-sensing electrodes and a row-by-column array of column-sensing electrodes,
>
> each column of column-sensing electrodes interconnected by conductive traces,
>
> the row-sensing electrodes and column-sensing electrodes defining interleaved combs therebetween,
>
> <u>each column-sensing electrode overlapping at least two row-shaped, row-sensing electrodes,</u>
>
> each comb comprising at least two fingers.

Currently amended independent claim 13 is:

> A capacitive touch pad comprising cover and first layers,
>
> the cover layer comprising a non-conductive cover providing galvanic isolation of the first layer,

the first layer comprising a plurality of row-shaped row-sensing electrodes and a row-by-column array of column-sensing electrodes,

each column of column-sensing electrodes interconnected by conductive traces,

the row-sensing electrodes and column-sensing electrodes defining interleaved combs therebetween,

each column-sensing electrode overlapping at least two row-shaped, row-sensing electrodes,

each comb comprising at least two fingers,

the touch pad further comprising a second layer,

the first layer lying between the cover and second layers,

the second layer comprising a ground plane.

Currently amended independent claim 15 is:

A capacitive touch pad comprising cover and first layers,

the cover layer comprising a non-conductive cover providing galvanic isolation of the first layer,

the first layer comprising a plurality of row-shaped row-sensing electrodes and a row-by-column array of column-sensing electrodes,

each column of column-sensing electrodes interconnected by conductive traces,

the row-sensing electrodes and column-sensing electrodes defining interleaved combs therebetween,

each column-sensing electrode overlapping at least two row-shaped, row-sensing electrodes,

each comb comprising at least two fingers,

wherein in the first layer further comprises annular copper around the electrodes.

Currently amended independent claim 19 is:

A capacitive touch pad,

the touch pad defining top, bottom, left, and right edges,

the pad comprising cover and first layers,

the cover layer comprising a non-conductive cover providing galvanic isolation of the first layer,

the first layer comprising a plurality of row-shaped row-sensing electrodes each extending toward the left and right edges, and a row-by-column array of column-sensing electrodes,

each column of column-sensing electrodes interconnected by conductive traces,

the row-sensing electrodes and column-sensing electrodes defining interleaved combs therebetween,

each column-sensing electrode overlapping at least two row-shaped, row-sensing electrodes,

each comb comprising at least two fingers,

at least one regular row-shaped row-sensing electrode having fingers extending toward the top edge and having fingers extending toward the bottom edge,

at least one row of column-sensing electrodes having fingers extending toward the top edge and having fingers extending toward the top edge.

The Applicant respectfully points out that Yoshida is actually an inappropriately applied reference for several reasons, which are discussed as follows:

Yoshida Does Not Teach the Use of Force-Based Piezoelectric Transducers for Touch Pads/Screens

As previously pointed out by the Applicant, Yoshida actually teaches away from the use of comb-shaped electrodes because, *inter alia*, comb-shaped piezoelectric transducers (electrodes) are relatively complex. *See* Yoshida at Col. 2, lines 7-19. Moreover, the use of

piezoelectric effects in the fashion taught by Yoshida is incompatible with the capacitive type of sensing taught by Owens. The Examiner was invited by the Applicant to show support for why someone skilled in the art would combine Owens and Yoshida to somehow come up with the disclosure of claim 1 (that is, derive each of the elements of claim 1 as well as cooperative relationships between the found elements to form claim 1). More specifically, the Examiner was asked to show support for the proposition that "the piezoelectric material are well known to one [of] ordinary skill in the art as transducer or sensor for touch pad sensors". The Examiner has responded to this argument previously made by the Applicant by citing U.S. Patent Application Publication No. 20010022406 A1 to Woodmansee *et al.* (Woodmansee) and IBM Technical Disclosure Bulletin NN8905367 (May 1989).

Woodmansee's Force-Based Pressure Sensor Is Unrelated to a Computer Touch Pad

However, in Woodmansee, what is disclosed is a pressure-sensing force-based piezoelectric sensor to facilitate the mating between a compression mold and a workpiece, with the sensor(s) in Woodmansee only detecting the mating on a vertical (z) axis. Moreover, the force-based sensor in Woodmansee has no reasonable relationship to a computer touch pad or computer touch screen. In other words, the Woodmansee reference is highly unlikely to be consulted by one skilled in the art for the present application to arrive at a solution for fine-controlled location and movement sensing for a computer touch pad.

IBM Technical Disclosure Bulletin NN8905367 Only Proposes SAW-Type Uses of Piezoelectric Transducers for Fine Location and Movements Across a Touch Screen

In the case of IBM Technical Disclosure Bulletin NN8905367, that disclosure clearly does not even contemplate using a force-based piezoelectric transducer as a location and movement detector over the area of a touch screen/touch pad. Rather, IBM Technical Disclosure Bulletin NN8905367 merely discloses the use of surface-acoustic-wave (SAW) transmitters with corresponding SAW sensors. In should be noted, however, that one of the SAW strategies in IBM Technical Disclosure Bulletin NN8905367 also employed a separate, single force-based piezoelectric transducer under the layers of the touch screen/touch pad for the sole purpose of detecting pressure in conjunction with the location and movement detection by the SAW-based perimeter piezoelectric transducer acoustic-signal drivers and corresponding receivers. (A more-detailed discussion of SAW piezoelectric transducer schemas versus force-based piezoelectric schemas is presented later in this response.)

In other words, the Applicant has diligently studied IBM Technical Disclosure Bulletin NN8905367and simply cannot come up with a passage that would disclose the use of a matrix of piezoelectric transducers disposed within the underlying layers of a touch pad for the purposes of fine-location detection and movement detection. To the extent that the Applicant's original challenge to the Examiner was not specific-enough as to cause the Examiner to consider this point, the Applicant respectfully requests that the Examiner reconsider the issue.

The Introduction of Woodmansee and IBM Technical Disclosure Bulletin NN8905367 to Justify the Combination of Owens and Yoshida Constitutes a New Ground of Rejection

In the present Supplemental Office Action and its parent Office Action, the Examiner has introduced both Woodmansee and IBM Technical Disclosure Bulletin NN8905367 to justify the combination of Owens and Yoshida, which in effect constitutes a new ground of rejection for all of the associated claim rejections. In effect, the Applicant respectfully submits that the Examiner has turned an alleged two-way obviousness rejection into a four-way obviousness rejection. Accordingly, even if the Examiner decides to maintain the rejections after consideration of this response, the Applicant respectfully requests that the Examiner reclassify the present Office Action as *non*-final.

Force-Based Piezoelectric Transducers Are Not Used in the Art to Track Fine Locations and Movements on a Computer Touch Pad or Touch Screen

At the time of invention for the present patent application, piezoelectric transducers (electrodes), when used as mere force-based sensors (as opposed to surface-acoustic-wave (SAW) transmitters with corresponding SAW sensors), were generally considered too large/bulky and/or influenced by surrounding forces/acoustic waves to be effectively used in within the "touch" areas of touch screen applications, let alone touch pad applications. The Examiner has even listed and/or cited many references that teach the preferred use of piezoelectric sensors relating to touch screens and touch pads as being SAW transmitter-detector sets configured across the X and Y axes of a touch pad or touch screen. *See e.g.,* U.S. Patent No. 6,911,973 to Katsuki *et al.*, U.S. Patent No. 6,762,753 to Satoh *et al.*, U.S. Patent No. 7,230,612 to Satoshi *et al.*, and IBM Technical Disclosure Bulletin No. NN8905367. None of these references cited by the Examiner teach using a matrix of force-based piezoelectric transducers as a touch pad movement-tracking scheme. Rather, finger-movement tracking across a touch pad or touch screen using piezoelectric transducers generally employ a SAW-attenuation-

measurement schema. Conversely, independent claims 1, 13, 15, and 19 each use an interleaved matrix of capacitance electrodes (with the column electrodes overlapping multiple rows of electrodes) that comprise the touch pad area to make direct capacitance measurements of the both the X and Y positions of a user's finger across a touch pad.

Therefore, one ordinarily skilled in the art would not consult Yoshida, and even if Yoshida was consulted, Yoshida would not prompt that person to develop the interleaved matrix of capacitance electrodes used within the layers of the touch pad of the claimed invention.

Piezoelectric Transducer "Combs" Have Nothing to Do With Increased Touch-Detection Area Coverage

It is important to realize that comb-shaped piezoelectric transducers have been known in the electrical arts for decades, but not because the "electrode combs" provide fine position detection when a button or key is pushed. Rather, the interleaved electrodes of piezoelectric transducer applications allow for a greater mechanical displacement to voltage ratio, and vice versa. The "comb teeth" in a single piezoelectric transducer are additive in effect. For a given small input voltage, a much greater mechanical displacement (e.g., sound, flexing deformations, etc.) can be achieved as compared to the application of the same small voltage to a single-element piezoelectric transducer. Similarly, the parallel displacement of all of the "comb teeth" of a piezoelectric transducer produces a much greater (and therefore useful) charge displacement (i.e., voltage output signal) than would be obtained had the piezoelectric transducer simply had one element. *See e.g.,* Newnham, R.E., Bowen, L.J., Klicker, K.A., and Cross, L.E., "Composite Piezoelectric Transducers", Materials in Engineering, Vol. 2, (December 1980), pg 104 (Exhibit A).

Notably, the SAW-type applications of piezoelectric transducers in the references cited by the Examiner discussed *supra* do not use single-element transducers despite not being located within the touch pad/touch screen user area. This is because multiple-element transducers work much more efficiently to both generate the surface-acoustical wave and to receive the generated and perhaps user-attenuated surface-acoustical wave.

Simple, force-based piezoelectric transducers are used for detecting the up-down pressure/strain on an item (such a key), and perhaps the magnitude of said pressure exerted on the transducer. Conversely, the interleaved "fingers" of the capacitance electrode matrix of

independent claims 1, 13, 15, and 19 are used to simply maximize and enhance the detectable area and tracking capabilities of the touch pad. The interleaving of the comb teeth of a single piezoelectric transducer simply is not analogous to the interleaving of rows and columns of capacitance electrodes in the current claimed invention. Therefore, the Examiner is erroneously equating a "comb" in a single piezoelectric transducer with the complex, heavily interleaved capacitance matrix of the present claimed invention.

The Combination of Yoshida and Owens Does Not Disclose the All of the Elements of Claims 1, 13, 15, and 19

Each of currently amended claims 1, 13, 15, and 19 recite a limitation where each column-sensing electrode must overlap at least two row-shaped, row-sensing electrodes. The undersigned has diligently reviewed Yoshida, Owens, Woodmansee, and IBM Technical Disclosure Bulletin NN8905367, and cannot find such a limitation. Thus, the Examiner's 35 U.S.C. § 103(a) obviousness rejection of each of these independent claims must fail.

Obviousness Rejections of Dependent Claims 2-7, 9-12, 14, 16-18, and 20-30

The Examiner has rejected dependent claims 4-7, 9-12, 14, 16-18, and 23-30 under 35 U.S.C. § 103(a) as supposedly being obvious over Owens in view of Yoshida. In addition, the examiner has rejected dependent claims 2, 3, 20, and 21 under 35 U.S.C. § 103(a) as supposedly being obvious over Owens in view of Yoshida, in further view of U.S. Patent Application Publication No. 2003/0234773 A1 to Sano *et al.* (Sano).

Dependent claims 2-7 and 9-12 incorporate all of the limitations of independent claim 1. Dependent claims 14, 17, and 18 incorporate all of the limitations of independent claim 13. Dependent claim 16 incorporates all of the limitations of independent claim 15. Dependent claims 20-30 incorporate all of the limitations of independent claim 19. Independent claims 1, 13, 15, and 19 are allowable for the reasons discussed *supra*. Therefore, the claims dependent on each independent claim must also be allowable. Accordingly, all 35 U.S.C. § 103(a) rejections of dependent claims 2-7, 9-12, 14, 16-18, and 20-30 should be withdrawn.

Conclusion

For all of the reasons stated herein, the Applicant has presented amendments, arguments, and facts that refute all of the Examiner's claim rejections. Therefore, the Applicant respectfully requests that all claim rejections be withdrawn and that a Notice of Allowance be issued.

Respectfully submitted,

/s/
Terrence M. Wyles
USPTO Reg. #61,035